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Poster

Advances in space weather modeling, data assimilation, instrumentation, and the growth in real-time observational networks enable the simulation of the ionosphere in 3D across wide spatial regions in near-real-time. Here, we present HAWK-I: High-latitude Atmospheric WorKbox for the Ionosphere, which is designed to provide a near-real-time specification of the high-latitude ionosphere in near-real-time and generate tailored operational products for Users. The framework is being developed and optimized for use in a real-time operational environment (R2O2R). HAWK-I uses multiple background models of Earth's ionosphere along with the data assimilation algorithm H-IDA4D (High latitude Ionospheric Data Assimilation 4D). H-IDA4D is an advanced version of IDA4D, tailored for use in the high-latitudes. It produces 4D time-dependent electron-density maps through variational analysis.

Three models are used to provide background ionospheres for HAWK-I. Real-time (NTRIP) data from GNSS ground stations and satellite Radio Occultation (RO) data from COSMIC-2, Spire, and PlanetiQ are assimilated to generate near-real-time Nowcast products. An included High frequency Ionosphere Interface Tool box (HIIT) creates 2D and 3D ray-trace output products using the modeled ionospheres (i.e., using the IRI ionosphere vs. SAMI3 vs. E-CHAIM). Near-real-time Ionospheric Scintillation and Rate of TEC Index (ROTI) products are also generated. Observational data from the Poker Flat Incoherent Scatter Radar (PFISR) and are used to validate the results. Since the current focus is the high latitudes, where the dynamics and chemistry can change very quickly, we use a 5-minute modeling + data assimilation cadence and we only ingest near-real-time data that can be automatically processed.

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